

rence was trivial. After a time, however, a crash a hundred feet below us and perhaps 590 feet away, and the immediate terror of the horse drew us to the door. As we emerged, every artificial projection on the summit was giving forth a brush discharge of electricity. The corners of the eaves of the observatory (made of Malthoid roofing), the arrow of the wind-vane, the cups of the anemometer—each sent forth its jet, while the high intake pipe of the precipitation tank on the apex of the summit was outlined with dull electric fire. Whenever our hands rose in the air every finger sent forth a vigorous flame, while an apple, partially eaten, in the hand of Captain Brambila sent forth two jets where the bite left crescent points. This latter phenomenon occurred, however, only when the apple was raised and ceased when it was lowered, so that the eating of the apple involved no visible eating of flame. To clap the climax, my felt hat above the brim flashed suddenly into flame. I could feel the draft, and it seemed to me I could hear it, too. The halo was dazzling, but before the senses could act it was gone. I had earlier rubbed Captain Brambila's hair, trying (but ineffectually) to elicit a discharge of electricity; because he was not so tall as I, nature selected me to serve as the point of electric discharge. So vivid were the flames that continued steadily to play from the corner of the observatory that I reached up to assure myself that the building was not actually on fire.

We felt no ill physical effects nor any special alarm, but for the sake of prudence we sought the interior of the observatory, where the pranks of the electricity were apparently completely avoided. About 7:30 p. m., an hour after the electric storm had burst, it had vanished. The clouds, however, continued to hover around the summit, and the following evening a heavy rainstorm swept from the mountain earthward toward Reno, gaining violence as it descended, until the valley was drenched. We followed the storm closely with but little inconvenience from rain.

Only once before have I met electricity actively present on Mount Rose. This was during the day of July 25, 1906, in a wet snowstorm accompanied by dense fog. At that time the thunder was pealing in the abyss below me, until I felt like some Jupiter hurling thunderbolts upon the earth beneath. Evidently the potential is higher during snowstorms, as Professor McAdie believes, than at other times; at least the fatality on Mount Whitney occurred during a snowstorm.

The puzzle is that the discharge took place not at the summit, but upon the rocks below. A possible reason may be found in the suggestion of Dr. R. S. Minor that the "scud" which was sweeping between the heavier clouds above and the mountain mass may have become electrified by passing between the two poles, and then have discharged its electricity as it was swept down nearer the mountain, where the air currents swirl in its lee."

So far the discharges on Mount Rose have occurred at this lower point, and this habit may prove to be the security of the observatory. The large extent of the summit over which the brush discharge was active and the intensity of the discharge indicate imminent danger to the entire observatory. It was believed, when the observatory was planned, that such bolts would be induced to strike the high intake pipe on the crest; but such a conductor, it seems, would prove insignificant on account of the gigantic proportions of the electric activity. Besides it is impossible to create a satisfactory circuit from tank to mountain, for the summit is apparently one mass of shivered rock whose interstices are filled only with dry earth.

A nice cage in which to sit during thunderstorms has been suggested as affording possible immunity for the observers. It is possible that the observatory itself, which is sheathed with Malthoid roofing above and nestled in the rocks below, may serve the same purpose. The placing of wire netting around the louvered shelter where the meteorograph is in-

stalled might afford protection, but the anemometer mast may attract sufficient electricity to fuse the netting and reach the instruments by way of the mechanical connections. There has been no actual danger on Mount Rose, so far as known, during the past three years, except on October 20, 1907.

EARTHQUAKES ON THE PACIFIC COAST.

By Prof. ALEXANDER G. MCADIE. Dated San Francisco, Cal., January 21, 1908.

It has been brought to my attention by Prof. George Davidson that Belcher gives a short list of some earthquakes on the Pacific coast. Mention of these earthquakes is not found in Holden's Catalog of Earthquakes on the Pacific coast, and publication at this time may be of interest to seismologists throughout the world. Professor Davidson has also shown me in an old book in his possession a note concerning an earthquake felt by Francis Drake in March(?), 1579. Drake had sailed from Panama on March 13, and a few days later, while anchored off the southern coast of Costa Rica, felt a sharp shock.

In Belcher's "Voyage Round the World," London, 1843, Vol. I, p. 147, appears the following record for Acapulco, Mexico:

As far back as the year 1732 earthquakes of uncommon force have continued to afflict this city. On the 25th of February of that year a very heavy earthquake destroyed nearly the whole town. The sea rose to a great height, covering the Plaza (or about 10 feet perpendicular), the successive risings, after receding, recurring slowly at the periods of the several shocks.

On the 17th of August, 1754, another earthquake occurred, ruining the greater part of the town. On this occasion the rising of the sea was attended with more violence; the Plaza was again covered.

On the 21st of April, 1776, an earthquake occurred which destroyed many houses.

On the 14th of March, 1787, the whole town was ruined. The sea retired, leaving the rocks of the Punta Manzanilla (in the town bay) dry. The *Philippine*, Nao, was anchored at the time in the port and was left in 4 fathoms before the tide returned—showing a fall of 36 feet.

No earthquake of consequence is recorded afterward until that of the 2d of May, 1820. This earthquake lasted several days, and entirely destroyed the place. The steeple of San Francisco fell on this occasion and the church was rent; the sea retired still farther than in 1787, and returned in two hours, rising up to the church door; the rise and fall taking place gently. At the ultimate recession the sand was found to have accumulated so as to nearly cover the pier (5 or 6 feet) by which upward of twenty varas of land was gained at the beach.

On the 10th of March, 1833, about 10 o'clock at night, a heavy earthquake was experienced. The sea retired 40 feet, and gently resumed its former level. This was felt at Mexico at precisely the same hour, lasting there about one minute and a half, the motion there being undulatory, but at Acapulco trepidatory.

On March 13, 1834, another shock is recorded; the sea receded fifty varas and several buildings were destroyed.

On the 6th of January, 1835, at 6 o'clock in the morning a very severe earthquake was felt, lasting upward of two minutes; motion trepidatory, the shocks recurring every thirty hours for upward of a month. This, like that of 1833, was felt in Mexico.

On the 9th of August, 1837, a heavy shock was felt, trepidatory, recurring at thirty hours for nearly three weeks. It was felt slightly at Mexico.

On the 18th of October, 1837, at 4 p. m., a heavy earthquake occurred, which lasted until the 22d. During this interval of four days the earth trembled continuously; one hundred separate shocks were counted between 4 p. m. 18th, and 10 p. m. 22d. During this interval five very severe shocks occurred, 4 p. m. 18th, 10 p. m. 19th, midnight 19th, 4 p. m. 20th, and 4 p. m. 21st. That at midnight on the 19th was terrific. Had it lasted a few seconds longer, rocks would undoubtedly have been rent asunder. Following this earthquake, for six weeks continuously, periodical heavy shocks were experienced, at 10 a. m., 10 and 12 p. m., and at dawn. At Mexico the shocks were severely felt at the same instants, on the 18th and 19th.

In conclusion *daily temblors* have occurred since the earthquake of 1820. But the season when the heaviest shocks occur is between March and June.

The above is extracted from notes made by a commissary resident for many years, and constantly holding office under the government of all parties.

FURTHER OBSERVATIONS OF HALOS AND CORONAS.

By M. E. T. GHEURY. Dated Eltham, England, August 3, 1907.

The accompanying table¹ gives my observations of halos, coronas, etc., during April, May, and June, 1907.

¹This table closely follows in arrangement, abbreviations, etc., the table of the author's previous paper printed in the Monthly Weather Review, May, 1907, p. 213-215.—EDITOR.

Observations of halos, coronas, etc., at Eltham, England, April-June, 1907.

No.	Date and time of day, 1907.	Nature of phenomenon.	Previous min- imum.	Previous maxi- mum.	Mean barometer for preceding 24 hours.	Following min- imum.	Following maxi- mum.	Mean barometer for following 24 hours.	Weather at time of observation.	Weather during following 24 hours.	Description of phenomenon and general remarks.
1	2	3	4 ° C	5 ° C	6 Inches.	7 ° C	8 ° C	9 Inches.	10	11	12
20	April 4, 4 p. m.	Halo, S.	4.2	13.0	29.13, rising from 29.05 to 29.17.	4.2	14.0	29.33, variable....	Fine, cloudy, light wind.	Overcast, misty, light wind.	Halo of 22°, inner edge reddish.
21	April 5, 8:30 p. m.	Annulus, S.	4.2	14.0	29.34, variable....	7.7	15.0	29.23, falling from 29.36 to 29.11.	Cloudy, misty, light wind.	Cloudy, windy, heavy showers.	With undefined edge, intermittent, extending to 1 d.
22	April 6, 6 p. m.	Rainbow, S.									Double, inner one very strong, with four inner supernumerary purple bands, with green between (the first green band only visible), outer bow faint, with purple edge outside. Distance (not measured) equal to about eight times width of principal rainbow.
23	April 13, 6 p. m.	Annulus, S.	7.6	13.9	29.29, variable....	6.2	10.8	29.43, variable....	Fine, clear, light wind.	Overcast, rain....	With undefined edge, intermittent, yellow, extending 1 d.
24	April 20, 8:45 p. m.	Halo, S.	2.0	12.2	29.90, variable....	7.6	11.4	29.78, falling from 29.88 to 29.70.	Fine, light wind....	Overcast, rain all the time.	Halo of 22°, inner edge reddish, outer edge bluish.
25	April 22, 2:30 p. m.	Halo, S.	6.0	11.3	29.86, rising from 29.70 to 30.03.	6.1	15.4	30.08, variable....	Fine, still....	Overcast, strong wind.	Halo of 22°, inner edge reddish, outer edge bluish, lasted 20 minutes.
26	April 22, 4 p. m.	Halo, S.	6.0	15.4	29.89, rising from 29.70 to 30.05.	6.1	18.0	30.08, variable....	Fine, still....	Cloudy, strong wind, a little rain.	Halo of 22°, faint, milky, transient.
27	April 22, 12 midnight	Annulus, M.	6.0	15.4	30.00, rising from 29.80 to 30.12.	6.1	18.0	30.09, variable....	Fine, cloudy, light wind.	Cloudy, strong wind.	Undefined edge, extending 1½ d., outer edge slightly reddish.
28	April 23, 6 p. m.	Annulus, S.	6.1	18.0	30.09, variable....	7.8	21.3	30.08, steady....	Cloudy, windy....	Cloudy, light wind; fine and warm.	Undefined edge, to ½ d.; above and below a rudiment of pillar up to 1 d.
29	April 25, 10 p. m.	Corona, M.	11.0	18.0	30.01, falling from 30.09 to 29.96.	7.6	8.6	29.80, falling from 29.97 to 29.60.	Overcast, dull, light wind.	Pouring rain all day	No definite corona, only a reddish tinge around the moon, on the clouds passing on it.
30	April 26, 10 p. m.	Annulus, M.	7.6	8.6	29.80, falling from 29.97 to 29.60.	3.2	10.8	29.61, steady....	Overcast, still....	Fine, light wind; small storm, strong wind and pouring rain.	Moon silvery white, orange annulus, fairly sharp edge, width ½ d., intermittent.
31	April 27, 11 p. m.	Annulus, M.	3.2	10.8	29.61, steady....	1.8	10.7	29.64, variable....	Cloudy, light wind..	Cold, cloudy, strong wind.	Fairly sharp edge, width ½ d.; outside, another with undefined edge.
32	May 1, 7 p. m.	Annulus, S.	4.4	10.0	29.53, variable....	5.5	13.3	29.33, variable....	Cold, cloudy, windy.	Cloudy, gale, heavy rain.	With undefined edge, extending to 1 d.
33	May 5, noon.	Halo, S.	5.4	16.0	29.55, variable....	8.9	16.6	29.47, variable....	Warm, cloudy, light wind.	Overcast, strong wind, rain.	Halo of 22°, faint, partial, milky, intermittent.
34	May 8, 12:30 p. m.	Halo, S.	7.0	11.7	29.68, variable....	7.0	19.8	29.73, variable....	Warm, still, veiled sky.	Overcast, pouring rain, strong wind.	Halo of 22°, milky.
35	May 12, 5 p. m.	Halo, S.	14.8	27.0	29.60, steady....	14.4	19.5	29.64, variable....	Hot, light wind, veiled sky.	Overcast, rain....	Halo of 22°, milky.
36	May 12, 7:30 p. m.	Annulus, S.	14.8	27.0	29.60, variable....	14.4	19.5	29.65, variable....	Hot, light wind, cloudy.	Overcast, rain....	Undefined edge, extending to ½ d.
37	May 23, 10 p. m.	Halo and annulus, M.	10.8	21.1	29.47, variable....	10.9	20.1	29.57, rising from 29.47 to 29.76.	Warm, cloudy, light wind.	Overcast, distant thunderstorm, rain.	Halo of 22°, milky; annulus with undefined edge extending to ½ d.
38	May 24, 8 p. m.	Annulus, M.	10.9	20.1	29.55, rising from 29.45 to 29.74.	8.3	21.5	29.78, variable....	Fine, warm, cloudy.	Sky rapidly veiled, then quite pure, then overcast, some rain.	Visible before sunset, 8 p. m.; pale, defined edge, wider on limb than on terminator. 8:15 p. m., orange, with red edge; 8:30 p. m., wider, bright orange-red edge, outer purplish grey, annulus extending to 1 d.
39	May 24, 9:30 p. m.	Halo, M.	10.9	20.1	29.57, rising from 29.47 to 29.76.	8.3	21.5	29.79, variable....	Warm, veiled sky, still.	Sky rapidly veiled, then quite pure, then overcast, some rain.	Halo of 22°, milky, very faint.
40	May 31, 12:30 p. m.	Halo, S.	12.1	16.7	29.70, falling from 29.87 to 29.50.	12.1	20.1	29.32, falling from 29.50 to 29.25.	Hot, cloudy, light wind.	Overcast, rain; thick fog; thunderstorm pouring rain.	Halo of 22°, milky.
41	June 6, 5:30 p. m.	Rainbow, S.									Double, faint. Inner one with two inner supernumerary bows.
42	June 8, 8 p. m.	Annulus, S.	12.6	21.5	29.73, steady....	13.1	25.0	29.59, falling from 29.70 to 29.46.	Hot, cloudy, light wind.	Warm, cloudy; overcast, windy, rain.	With undefined edge extending to ½ d.
43	June 11, 3:45 p. m.	Halo, S.	11.3	21.5	29.67, variable....	14.1	20.1	29.56, falling from 29.70 to 29.48.	Hot, cloudy, still..	Overcast, windy, rain; fine and sunny with strong wind.	Halo of 22°, milky, inner edge slightly red; lasted 2 hours.
44	June 11, 6 p. m.	Annulus, S.	11.3	21.5	29.68, variable....	14.1	20.1	29.52, variable....	Hot, overcast, still..	Windy, rain; fine, sunny, strong wind, rain.	With undefined edge, white, extending to ½ d.
45	June 17, 10 p. m.	Annulus, M.	7.6	19.5	29.93, falling from 29.95 to 29.88.	11.0	18.7	29.78, falling from 29.88 to 29.69.	Warm, cloudy, still.	Overcast, strong wind, some rain.	Undefined edge, very faint, eccentric.
46	June 18, 10 p. m.	Corona, M.	11.0	18.7	29.78, falling from 29.88 to 29.69.	10.0	20.0	29.78, variable....	Warm, cloudy and starry, light wind, a passing shower.	Cloudy, strong wind.	Faint, intermittent, color from orange to red; distance of outer edge from limb, from 3 to 4 d.; one moment elliptical (minor axis in line joining the horns); one moment eccentric.
47	June 20, 1 p. m.	Halo, S.	11.1	20.0	29.76, variable....	11.7	21.7	29.57, variable....	Fine, sky veiled by cirri, fresh wind.	Overcast and dirty, very strong wind.	Halo of 22°, inner edge reddish, outer edge bluish.
48	June 20, 10 p. m.	Annulus, M.	11.1	21.7	29.67, falling from 29.82 to 29.48.	11.7	20.5	29.62, variable....	Overcast, stormy, strong wind.	Cloudy, very strong wind.	Undefined edge, extending to ½ d.
49	June 22, 11 p. m.	Corona, M.	11.8	20.3	29.70, variable....	10.5	19.0	29.73, rising from 29.67 to 29.80.	Fine, pure sky slowly covering, windy.	Overcast, strong wind, rain.	Faint, transient, reddish, from 5 to 6 d.
50	June 24, 10:30 p. m.	Corona, M.	10.1	16.9	29.65, falling from 29.79 to 29.51.	9.7	16.6	29.53, variable....	Pure sky, with passing clouds, strong wind.	Overcast, fresh gale during the night, then wet all day.	Intermittent, variable, sometimes very wide, from 4 to 6 d., and orange; at other times from 2 to 3 d., reddish, with somewhat sharper edges.
51	June 28, 1 p. m.	Corona, S.	12.2	20.7	29.74, steady....	9.3	19.5	29.76, variable....	Cloudy, light wind.	Overcast, misty, gloomy, light wind (severe thunderstorm, pouring rain).	Not directly visible. Seen and measured on virtual image produced by convex face of a bi-convex lens, also on the projected image (real). Reddish, from 2 to 3 d.
52	June 28, 4:30 p. m.	Halo and annulus, S.	12.2	19.5	29.75, steady....	9.3	19.4	29.75, variable....	Veiled sky, light wind.	Overcast, misty, gloomy, rain, light wind (severe thunderstorm, pouring rain).	Halo of 22°, yellowish; at 5 p. m. annulus extending to 1 d., halo still faintly visible.

DEDUCTIONS.

Annuli.—Fifteen observed.

Sun, 8. Three followed by rain, four by wind and rain, one by fine weather.

Moon, 7. Two followed by rain, three by wind, two by wind and rain.

Coronas.—Five observed.

Sun, 1. Followed by rain.

Moon, 4. One followed by rain, three by wind and rain.

Halos (single).—Thirteen observed.

Sun, 11. Three followed by rain, one by rain and fog, two by wind, four by wind and rain, one by fine weather (misty and overcast).

Moon, 2. Both followed by rain.

NOTE.—Corona No. 51 and annulus and halo No. 52 are included amongst the phenomena followed by meteorological disturbances, altho the storm followed later than twenty-four hours; because from the time of the observations there was a visible suspense before the imminent storm.

GENERAL REMARKS.

Altogether, of thirty-one distinct individual displays (the rainbows being neglected), there were—

Followed by rain, 11.

Followed by wind and rain, 11.

Followed by wind alone, 6.

Followed by rain and fog, 1.

Followed by fine weather, 2.

The failures are a halo and an annulus, both of the sun.

The observations of the second quarter confirm the results obtained during the first quarter, both as to the indication of approaching disturbances given by halos, coronas, and annuli, and as to the distinction between the latter and the coronas, together with which they never appear, while they are frequently seen simultaneously with halos.

Despite one failure, the annulus seems the best guide as to the following meteorological conditions. Annuli generally show themselves in perfectly fine weather, the next day being at first without the slightest sign of anything but a glorious day, to end with a veiled sky becoming rapidly overcast and with rising wind and rain. On the other hand, halos and coronas are visible only with a veiled and cloudy sky, when the weather is generally visibly unsettled and becoming rapidly worse.

The diameters of the coronas seem to depend on the kind of clouds; the thicker and the more tightly packed, the smaller the diameter. In some cases, with clouds of various concentration drifting before the moon, the corona produced was elliptical or eccentric, various parts being probably produced by vesicles of water vapor of different sizes, throwing the respective arcs of the corona at various distances from the limb.

Once, while cleaning in the open the object glass of my $3\frac{1}{2}$ -inch telescope, I saw in it a well-defined corona of the sun, tho on looking directly the dazzled eye could not distinguish it. Since then I am able to observe solar coronas with ease, and to take very good measurements of them. On looking in the lens so as to see the sun by reflection, four images are produced, one by each face of the achromatic system. The inner face of the biconvex lens gives too bright an image, but the outer face gives a virtual image of greatly diminished brightness which well shows the coronas when they are present. A large, long-focus lens gives better results than a small, short-focus one. The direct (real) image obtained by projection on a piece of white paper can be used successfully when only the latter kind of lens is available.

The summer hitherto has been very bad, being wet and windy, hence what I think will be an abnormally large harvest of these optical phenomena. I am endeavoring now to establish some correlation between the state of the sky and the

appearance of the phenomena, and the particular type of weather and degree of disturbance corresponding to each. For this a large number of observations must be gathered. I hope that some others may be induced to take up the work and help to elucidate many points which are marked in my observation book with a query. I think psychrometric observations should be useful, more useful than thermometric ones, but as yet I can not undertake them.

PURGING THE LISTS.

A small percentage of our correspondents cause themselves and the Publications Division not a little annoyance by not attending promptly to the "penalty" postal card sent annually, asking each to state whether or not he wishes to continue receiving the MONTHLY WEATHER REVIEW. A standing order requires all mailing lists to be revised annually, and this is accomplished by the postal-card method with the least possible trouble to all concerned.

NOTES ON THE JAMESTOWN TERCENTENNIAL EXPOSITION.

By JAMES H. SPENCER, Observer in charge of U. S. Weather Bureau exhibit.

One of the most creditable exhibits at the Jamestown Exposition was the aeronautical display, made by the Aero Club of America under the able direction of Mr. Israel Ludlow. The exhibit of balloons, dirigible balloons, aeroplanes, kites, models of flying machines, photographs, etc., was very complete and more attractively displayed than at any other exposition I have ever attended. Numerous dirigible balloon flights were accomplished by Mr. Lincoln Beechey and others. Mr. Ludlow upon several occasions attempted experimental flights with his aeroplane; these, however, were unsuccessful, due apparently to a lack of launching facilities. During the exposition Mr. Ludlow and his assistants gave instructive lectures on aeronautics.

The Weather Bureau exhibit at the Jamestown Exposition, tho somewhat less elaborate than at St. Louis and Buffalo, did not differ greatly in character from the exhibits at these two former expositions.¹

Much interest was taken in the Jamestown display, particularly the instrumental portion, which comprised one of the few "live" exhibits in "Government Building A." The Bosch-Omori seismograph displayed by the Weather Bureau was perhaps more frequently inspected by visitors than any other single exhibit in the building. The general desire on the part of visitors to see this instrument reflects the great interest in seismology that has been aroused by the recent severe earthquakes and the reports in the public press of the records obtained by the Weather Bureau.

The Weather Bureau exhibit was arranged in four sections, as follows:

Instrumental.—All the important instruments of the Weather Bureau were shown in this section, many of them in operation.

Aerial.—This section consisted of a Weather Bureau kite and reel and considerable self-recording and other apparatus for use in investigating upper air conditions by means of kites and balloons.

Educational.—On a large glass weather map were charted daily the weather conditions in all sections of the country, as shown by telegraphic reports. In this section were also displayed a large relief map and several smaller maps of the United States, showing the mean annual temperature and the average annual precipitation, sunshine, and other data. A

¹ A detailed description of the Weather Bureau exhibit at the Buffalo Exposition appeared in the Review for June, 1901, (Vol. xxix, p. 259-262 and plates I-IV) and of the St. Louis Exposition in the Review for September, 1904, (Vol. xxxii, p. 411-413.)